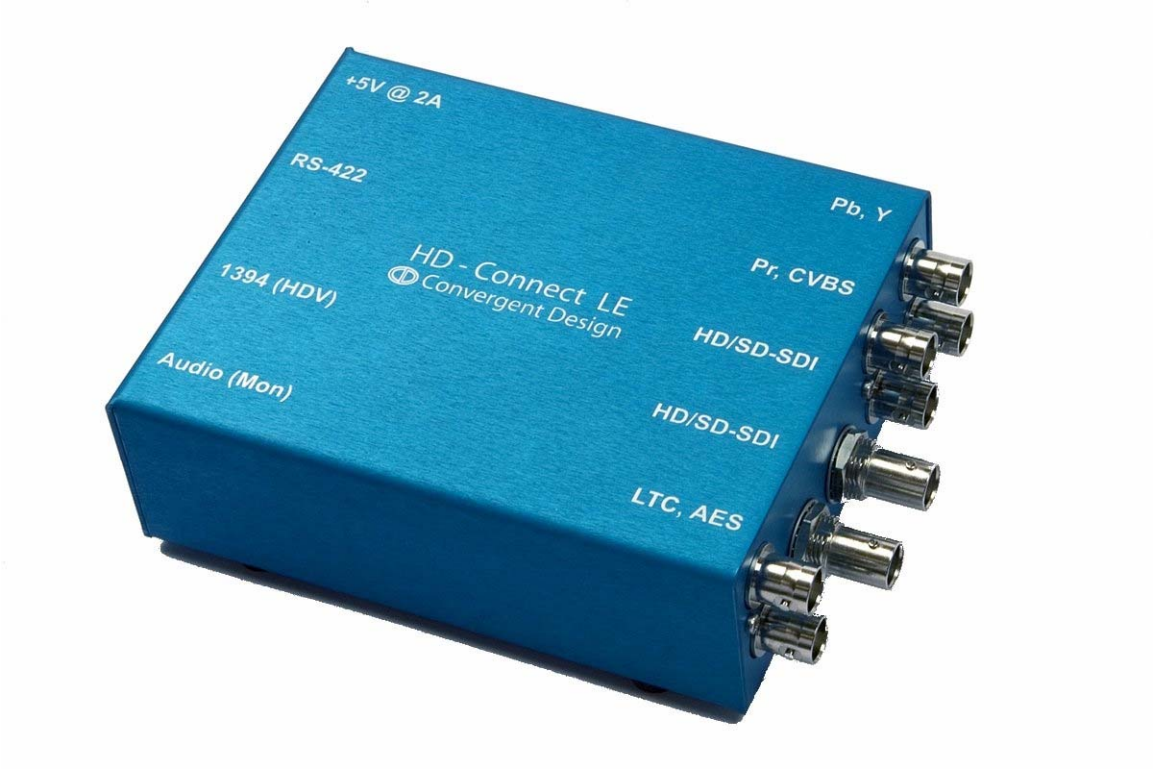
HD-Connect LE™
Guide and User's Manual



Convergent Design

4465 Northpark Drive, Suite 201
Colorado Springs, CO 80907
http://www.convergent-design.com
support@convergent-design.com
Support: 720-221-3861
Toll-Free: 866-654-0080

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1 Getting Started

1.1 Welcome

Congratulations on selecting Convergent Design HD-Connect LE™. HD-Connect LE™ is shipped from the factory in the most secure packaging available. Please inspect the content of the package and make sure to email us if you find any shipping damage or missing components.

1.2 FCC Compliance

This professional equipment has been tested and found to comply with the provisions for a Class A digital device under part 15 of the FCC rules. These provisions are designed to provide reasonable protection against radio-frequency emissions by digital devices in a commercial environment. This device may interfere with radio and television reception in residential areas and is required to accept all interference received, including that which may cause undesired operation.

1.3 Shipping Contents

Your HD-Connect LE™ should come packaged with the following:

1) HD-Connect LE™
2) Power Supply with Changeable Plugs
3) Quick Start Guide

2 HD-Connect LE™

2.1 Overview

The Convergent Design HD-Connect LE™ integrates video, audio, time-code and deck control into a simple to use, cost-effective box. This ultra portable unit offers the unique feature of conversion to HD or SD, allowing users to output to the widest variety of formats: HD-CAM, DVC Pro HD (via HD-SDI), DigiBeta or Betacam. HD-Connect LE offers two modes of deck control: RS-422 to 1394 and 1394 to RS-422. The RS-422 to 1394 deck control is intended for HD/SD-SDI based editing systems, while the 1394 to RS-422 mode (upcoming feature) is intended for HDV based editing systems.

The HD-Connect LE™ features an internal cross converter from 1080i to 720p HDV and 720p to 1080i.

The HD-Connect LE™ is your HDV connection, bringing HDV to your studio and edit bays as well as supporting over-the-air playout.

2.2 Features

1) HDV (over 1394) to HD/SD-SDI (with embedded audio and time code.) Embedded audio and time code is an upcoming feature for SD.
2) 720/24p, 720/25p, 720/30p, 1080/50i and 1080/60i support.
3) 50Hz (PAL) and 59.94Hz (NTSC) support..
4) HDV Deck Control via RS-422 →1394 and 1394→ RS-422 (coming soon) translation.
5) Component and Composite output.
6) Unbalanced Audio out (for local monitoring).
7) All outputs simultaneously active.
8) HD to SD scaling support. In HD, can cross convert 1080i↔720p.
9) 1394-based Firmware Updates.
10) DIP Switch Interface.
11) Color Bars and Tones on HD/SD-SDI (not available on analog outputs).
12) Anamorphic, Edge Crop, or Letter Box scaling selectable in SD.
13) Two 1394 ports (4-pin and 6-pin).
14) Dual identical HD/SD-SDI outputs.

2.3 Functional Block Diagram

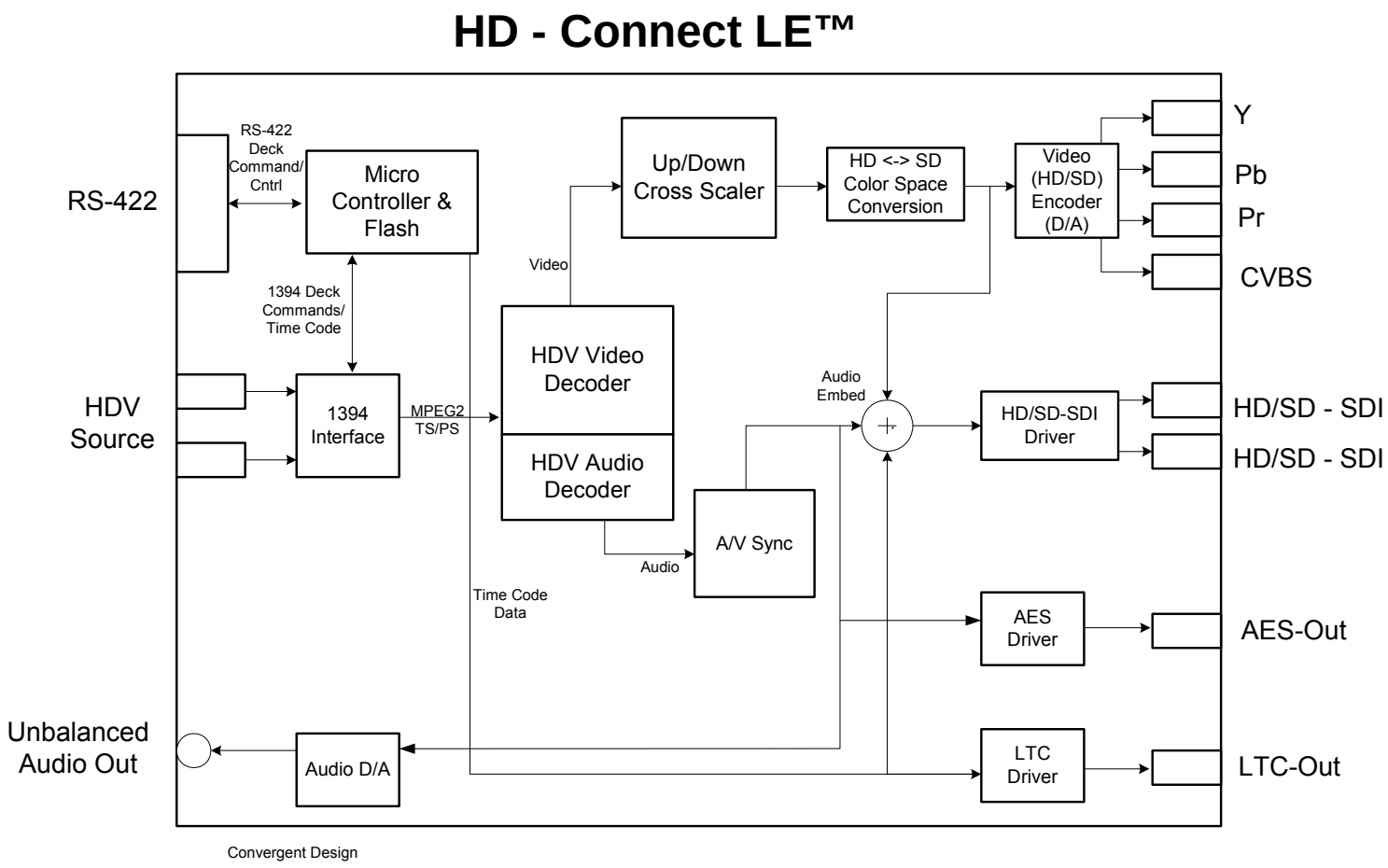


Figure 1 Functional Block Diagram of HD-Connect LE™

3 Installation and Quick Start

3.1 Connections

Refer to Figure 2 and the descriptions below when connecting HD-Connect LE™.

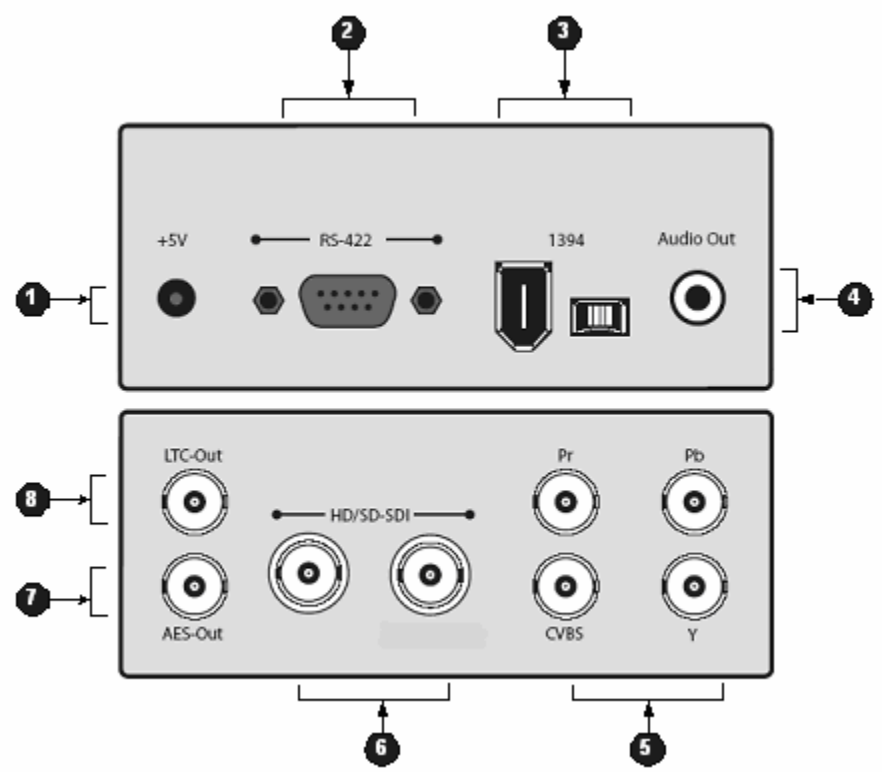


Figure 2 Connectors on the HD-Connect LE™

1) **DC +5V in:** Connect the supplied DC power supply unit.
2) **RS-422:** Connect to HDV based editing system for 1394→ RS-422 or to your SDI based editing system for RS-422 ↔ 1394.
3) **HDV In:** Connect to your HDV source. You can use either the 4-pin or the 6-pin 1394 connector. NOTE: HD-Connect LE™ can only use one 1394 HDV source at a time.
4) **Unbalanced Audio Out:** 3.5 mm unbalanced audio connector for monitoring. HD-Connect LE™ outputs audio simultaneously through this port, the AES port, and in the HD/SD-SDI stream.
5) **Analog Video Out:** Component HD and Composite SD output. CVBS is not active in HD mode. Component is active in both HD and SD.

6) **HD/SD-SDI Out** Dual HD/SD-SDI outputs. DIP switch 1 determines whether output is HD or SD.
7) **AES Out** Single-ended AES audio out.
8) **LTC Out** Single-ended Linear Time Code out.

3.2 DIP Switch Settings

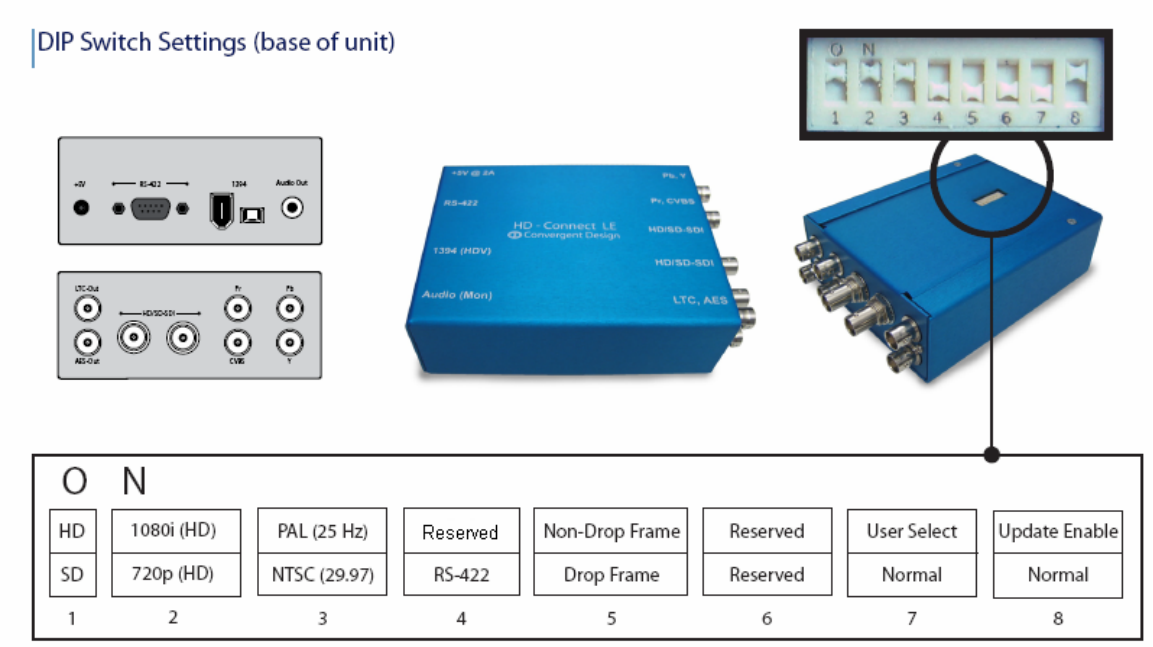

DIP Switch Settings (base of unit)
O N
1 2 3 4 5 6 7 8
HD - Connect LE
Convergent Design
Audio (Mon)
LTC, AES
O N
HD | 1080i (HD) | PAL (25 Hz) | Reserved | Non-Drop Frame | Reserved | User Select | Update Enable
SD | 720p (HD) | NTSC (29.97) | RS-422 | Drop Frame | Reserved | Normal | Normal
1 2 3 4 5 6 7 8

Figure 3 DIP Switch Settings on HD-Connect LE™

Figure 3 illustrates the DIP switch and its various control options. Below is an explanation of each switch and its functions:

1) Selects SD (Standard Definition) or HD (High Definition) video output for both HD/SD-SDI and analog.
2) Enables 720p or 1080i in HD (Switch 1=On).
3) Selects NTSC (29.97/59.94) or PAL (25/50) video standard – This must correspond to the HDV input format.
4) Selects deck control direction. Switch 4 = On enables 1394 to RS-422 control (upcoming feature) and Switch 4 = Off enables RS-422 to 1394 control. Currently Switch 4 = On is a reserved feature.
5) Selects NTSC timecode format. Switch 5 = On selects non-dropframe timecodes and Switch 5 = Off selects dropframe timecodes.

6) When used in conjunction with Switch 7, enables scaling features in SD and options enabled with the control application. See the table below for an explanation of these features.
7) Same as with Switch 6.
8) Enables flash memory update.

Switch 6	Switch 7	Feature
Off	Off	Style from Control App
On	Off	SD Letterbox
Off	On	SD Edge Crop
On	On	SD Anamorphic

4 Updating HD-Connect LE™

4.1 Preparation

To prepare for updating the HD-Connect LE™, complete the following steps:

1) Download and install the update and control application from the website. Go to the HD-Connect LE™ downloads page at http://www.convergent-design.com/LEdownloads.htm . Here you may download the latest code updates for either PC or Mac. The page has links to .exe files to install the control application for either PC or Mac.
2) In order to run the control application, you will need the Java Runtime Environment 1.4.1 or better. If you need this to be installed on your machine, follow the instructions on the product downloads page where the .exe files are located.
3) Connect the HD-Connect LE™ to your computer via the 1394 port with the DIP switch 8 set to the "On" position. It is recommended that the control and update application not be run alongside other applications that use the 1394 port.

4.2 Using the Update Application

Follow the instructions below to complete the update process using either a PC or a Mac.

PC

1) Connect the HD-Connect LE™ to your computer using the 1394 port. You must wait for your computer to recognize the box before the update application will work. This will take around 30 seconds. In Windows XP, a window similar to Figure 4 should pop up. For Mac, there is no indicator and it is recommended you wait for 30 seconds.

Digital Video Device
Windows can perform the same action each time you connect this device.
What do you want Windows to do?
Record Video using Windows Movie Maker
Capture Digital Video using Sony Vegas 5.0
Edit and Record Video using Adobe Premiere Pro
Capture Digital Video using Sony Vegas 6.0
Always perform the selected action
OK
Cancel

Figure 4 Windows XP recognizing the box.

2) Install the update and control application by running the .exe. Figure 5 shows the installation process.

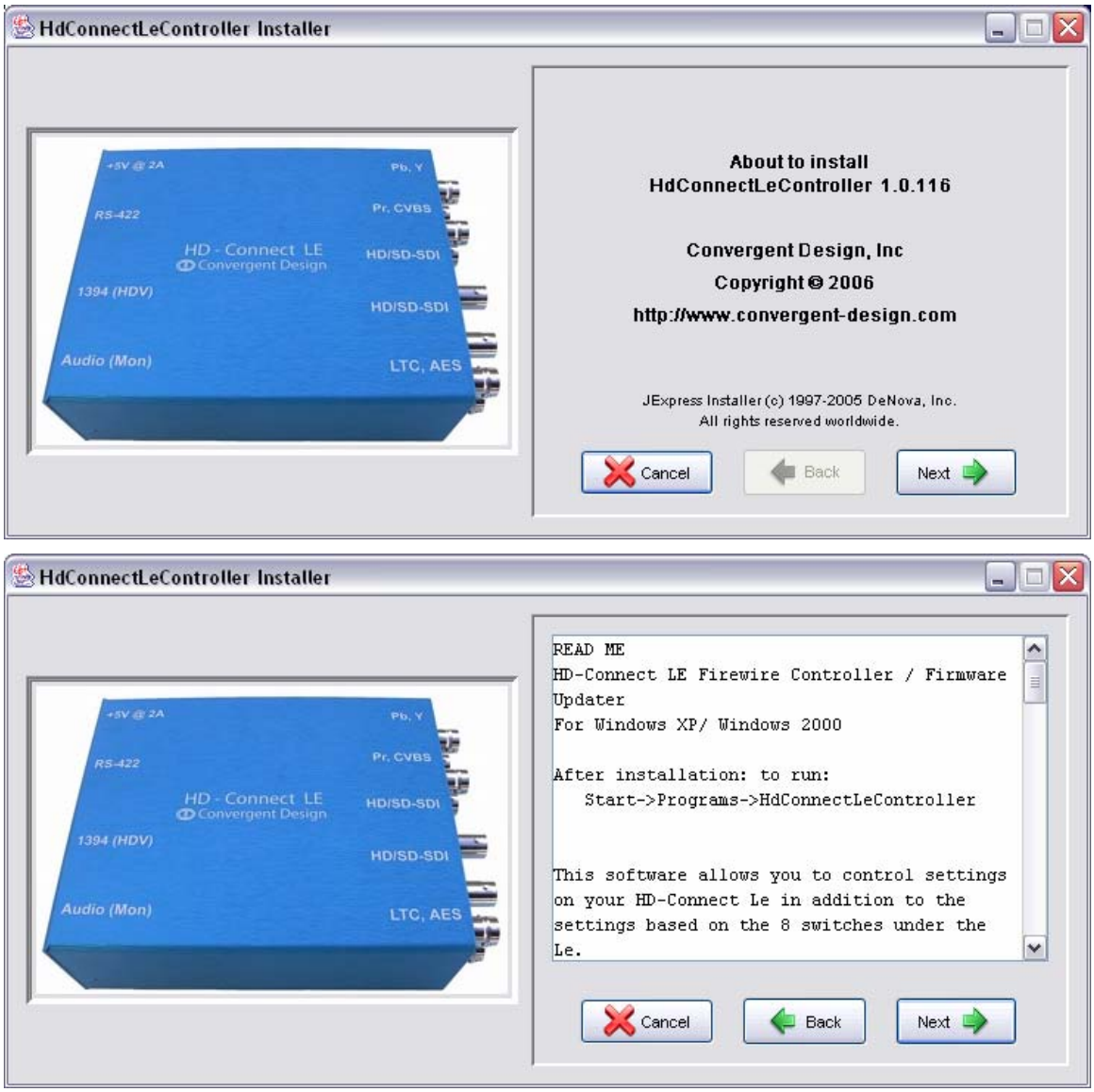


Figure 5 Installing the Control Application the PC & Mac

3) From the Start Menu, open the newly installed application "HdConnectLeController". When the application first starts, it will check online for available updates. You will be prompted to update it upon first use, click ok. When the update is finished, you will need to restart the application. Figure 6 shows the dialog window.

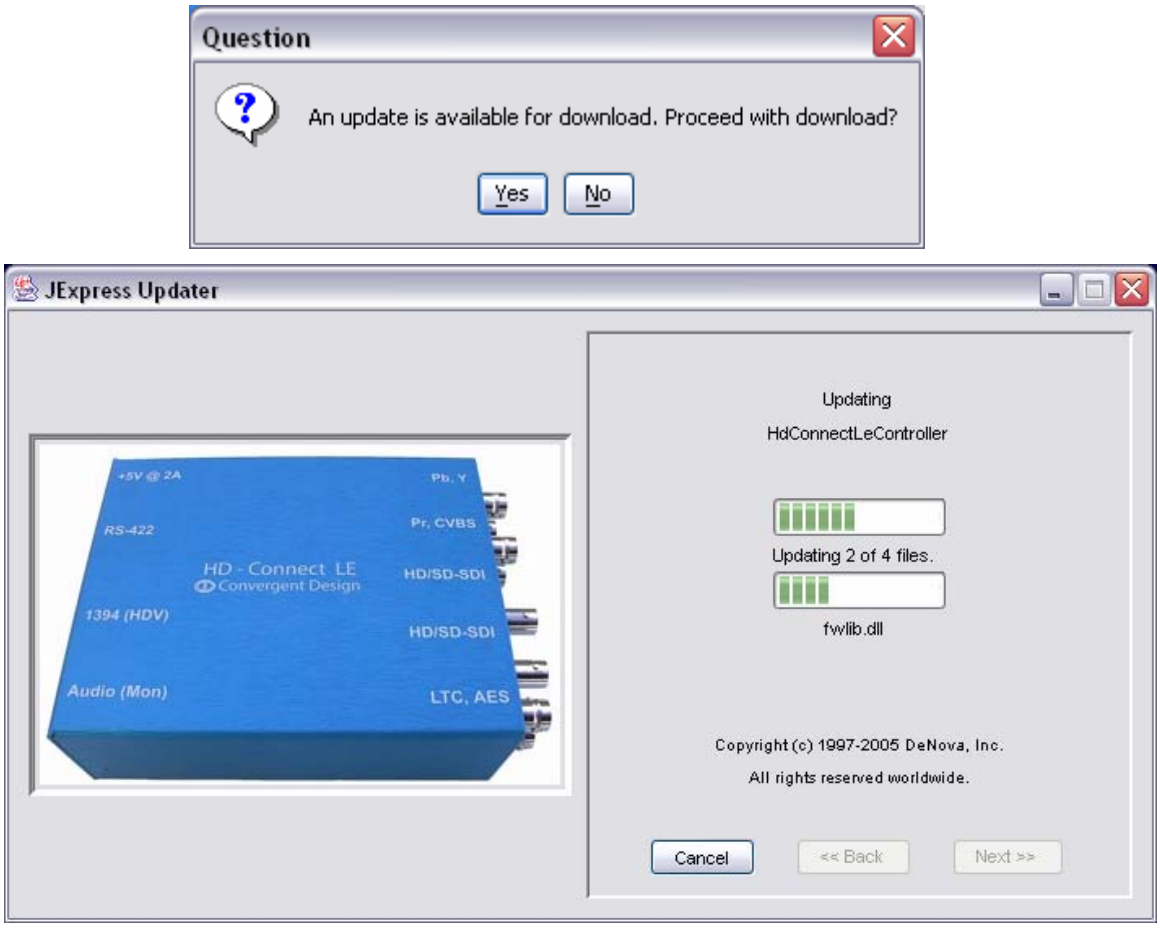


Figure 6 Control Application Asking for Updates

4) Open the Control Application again. With the box in update mode (Switch 8 = On), click on the “Firmware Update” tab, and click the “Refresh” button to check the current software loaded into the HD-Connect LE™, and display the newest version to update to. Figure 7 illustrates.

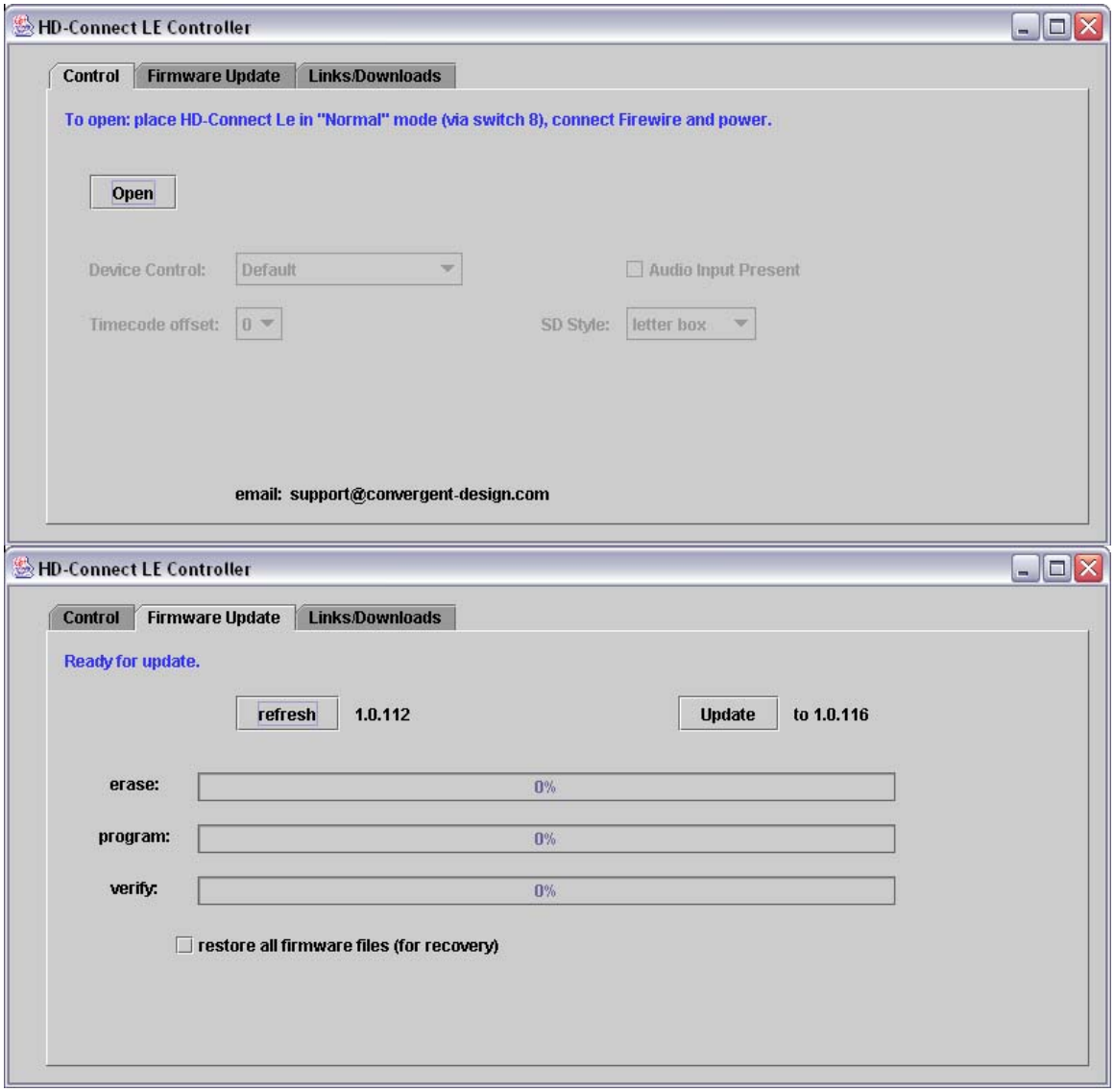


Figure 7 Using the Update Application

5) Click on the “Update” button to begin the update. It is recommended that you record the current version before updating the box, so that you can roll back to it if the new version does not work. Check the “Restore All Firmware Files” box if your box did not complete an update or if the box is in an unstable state. This process takes 3-6 minutes. During that time **DO NOT** unplug the box. A success window will appear when the update is complete. See Figure 8 for a screenshot of a complete update.

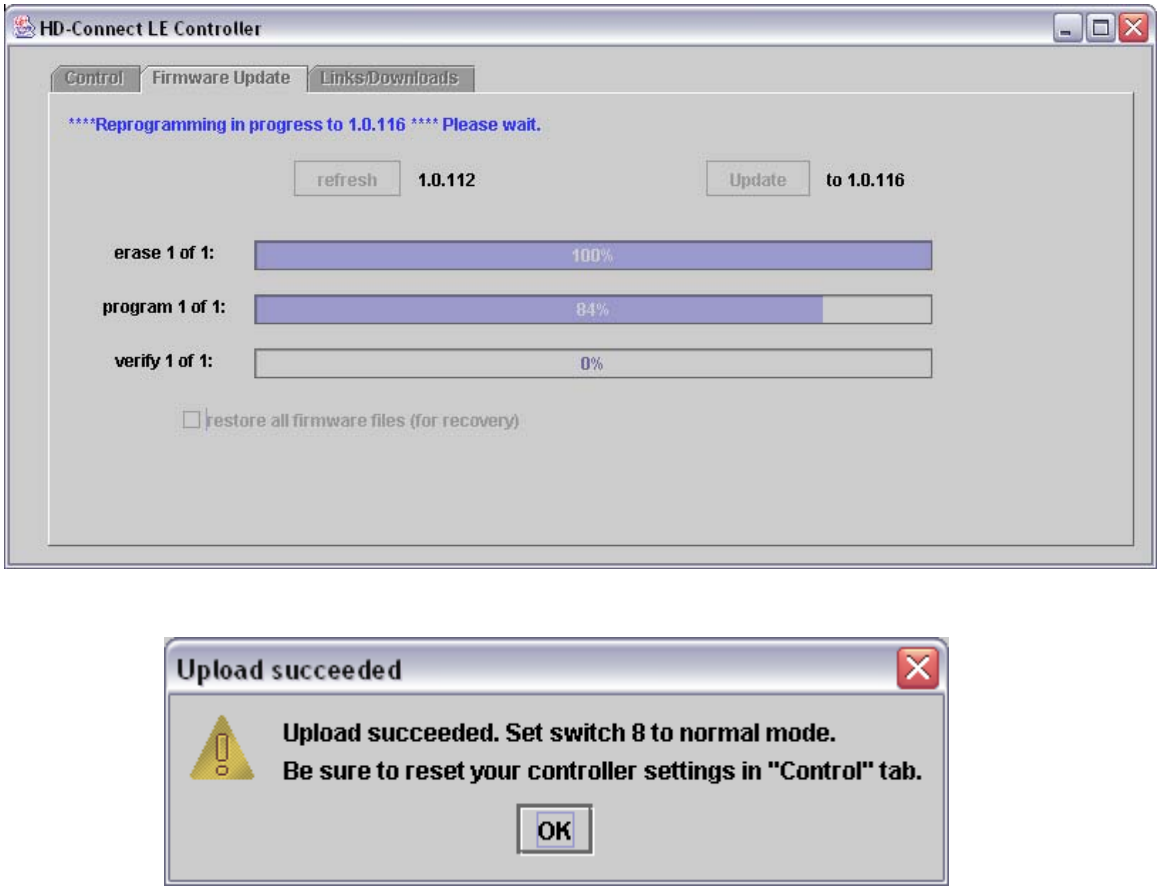


Figure 8 Update Application in Action.

6) Once the update is complete, close the application and take the box out of update mode by switching selector 8 to the “Off” position. All normal operations cease while the box is in update mode, so it is important not to forget this step.

Mac

1) For the Mac OSX, the procedure for installation is identical to the PC. Follow the instructions as before. Figure 9 shows the Mac installer window.

Figure 9 Mac OSX Installer Screen

2) Open the HD-Connect LE Update Application window itself, using Finder to locate the Applications, and select “HdConnectLeController”. Figure 10 illustrates this.

Figure 10 Finder in OSX

3) When you open the application, it should appear as in Figure 11. Use the exact same procedure for PC to update the box. With the box in update mode, click the “Refresh” button, then click the “Update” button. The update should take around three to five minutes. During that time DO NOT unplug the box.

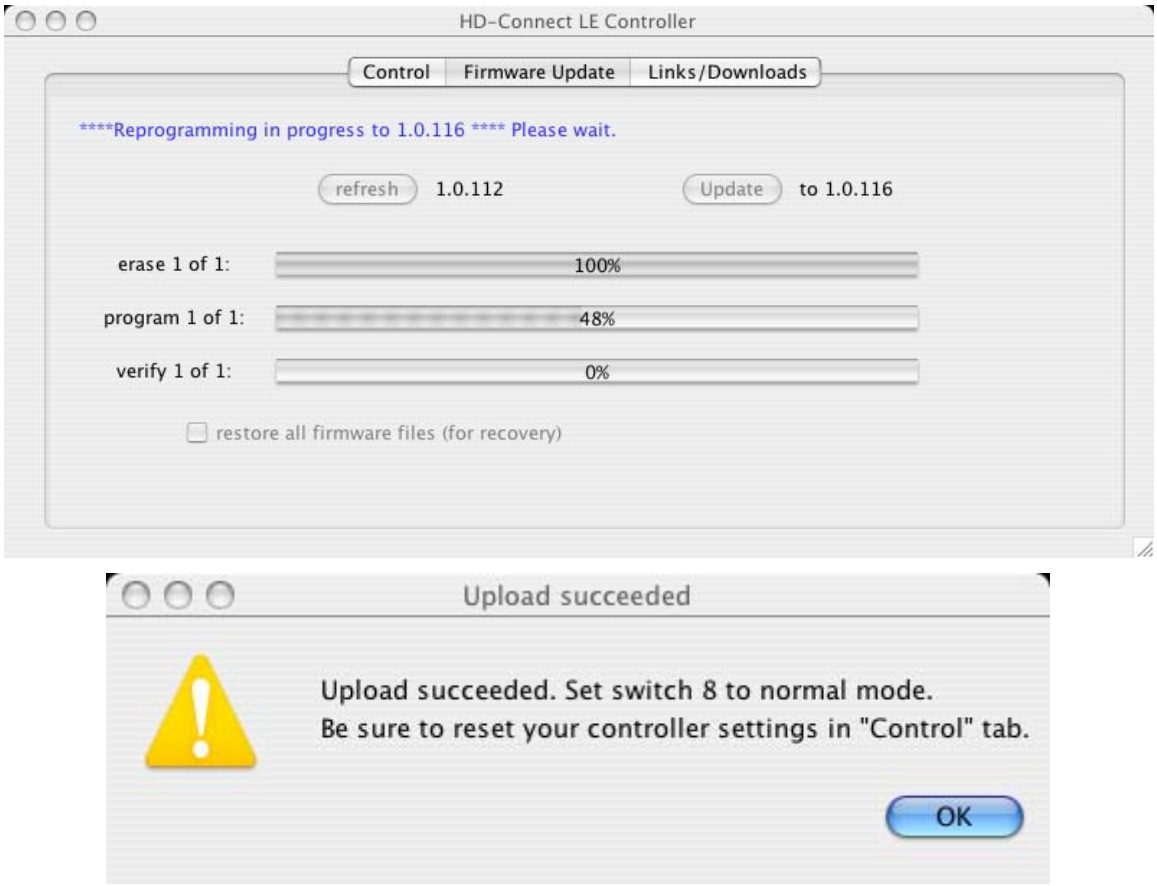


Figure 11 Mac Update Application

4.3 Rollbacks

Firmware updates will appear periodically on the website, so stay tuned. If you update your HD-Connect LE™ as described above and find problems with the box in your application, you can roll back to a previous code version using the Control App. To do this, with the box in Update mode, click on the "Links/Downloads" tab. Click on "Refresh List". Using the drop down menu, select the code you wish to use. This tells the Control App what code to load when it is restarted. Close the Control App, restart it and allow it to download the appropriate code, then proceed with the normal update procedure. Figure 12 below shows the "Links/Downloads" tab.

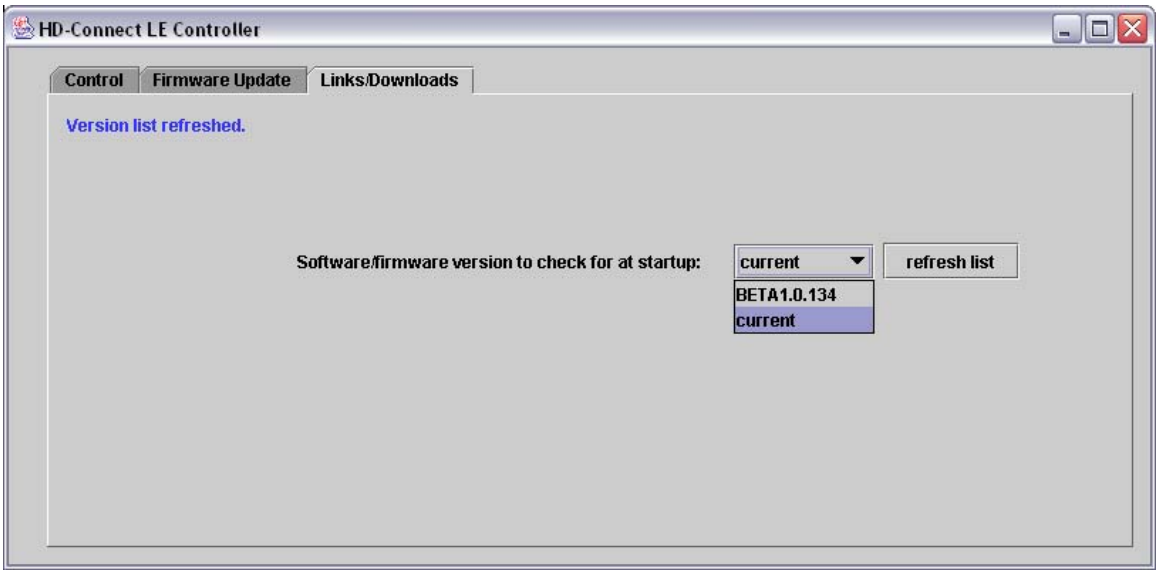


Figure 12 Code Rollback Feature in the Control App

5 Controlling HD-Connect LE™

5.1 Preparation

To prepare for using the HD-Connect LE™ control application, you need only ensure that the box is not in update mode. If Switch 8 is still in the “On” position, you will see a popup similar to the one below in Figure 13.

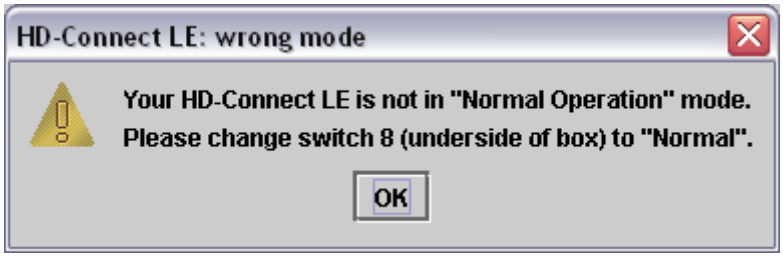

HD-Connect LE: wrong mode
Your HD-Connect LE is not in "Normal Operation" mode.
Please change switch 8 (underside of box) to "Normal".
OK

Figure 13 Alert message when in update mode.

When selecting options in the Control App, occasionally the HD-Connect LE™ will lose track of the 1394 uplink and may give you either of the following alert messages. If so, we recommend unplugging and re-plugging the 1394 connection or power cycling the box.

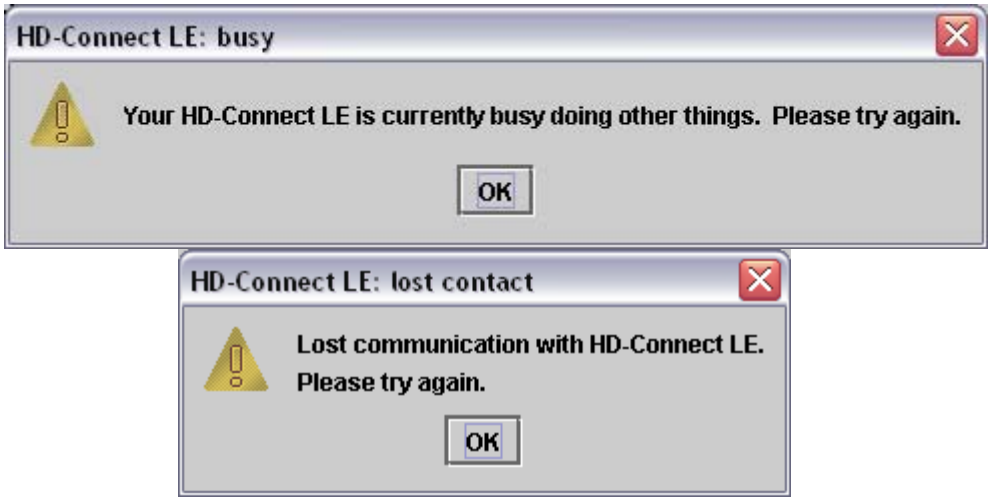

HD-Connect LE: busy
Your HD-Connect LE is currently busy doing other things. Please try again.
OK
HD-Connect LE: lost contact
Lost communication with HD-Connect LE.
Please try again.
OK

Figure 14 Error Messages

5.2 Using the Control Application

Follow the instructions below to complete the update process.

PC & Mac

1) Connect the HD-Connect LE™ to your computer using the 1394 port. You must wait for your computer to recognize the box before the control application will work. This will take around 30 seconds for either Windows XP or Mac.

2) Open and run the control application. Click on the “Open” button under the “Control” tab. The application will then display the current firmware version. Figure 15 shows a screenshot of the application.

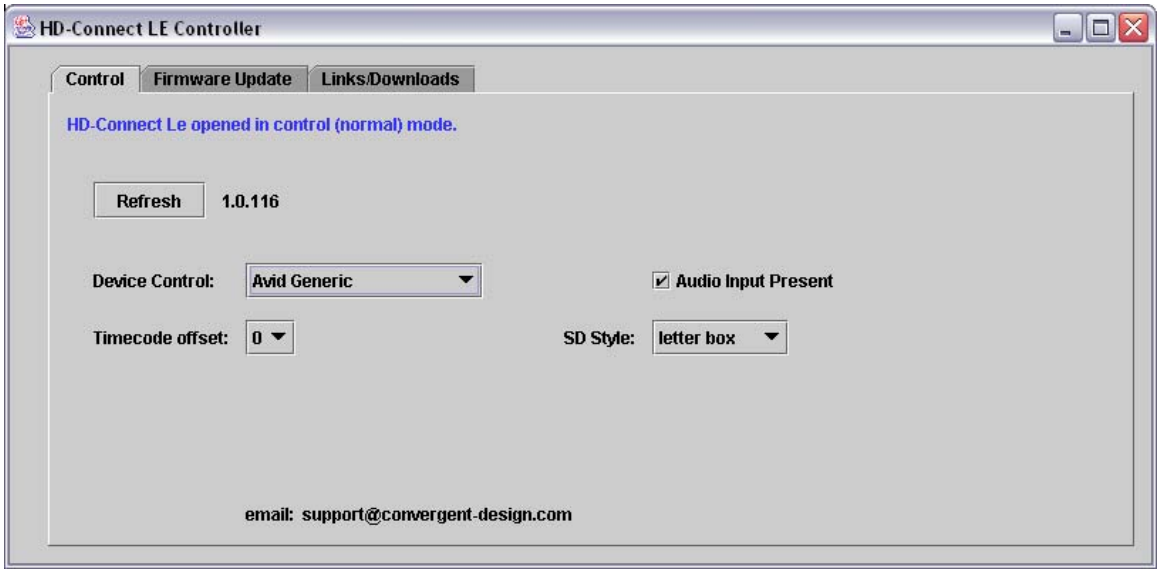


Figure 15 HD-Connect LE™ control application screen.

3) Perform the desired control operation as described below.

Control Operations

The operations available in the control application are described below. Following your selection of a list item, checkbox, or radio button, a message should appear confirming that your selection has been successfully loaded into your HD-Connect LE™ box. Figures 16-18 show the use of the control app for each operation. The interface for the PC and the Mac are identical in operation.

1) *Device Control.* The device-control dropdown list allows selection of a template representing a certain RS-422 controller or a set of controllers. The text box should display the controller currently selected. Click on the down arrow to show the list and click on the text identifying the template to select the controller the box should use. Once selected, the blue text should display a confirmation message. By default, HD-Connect LE™ comes pre-loaded with “Avid Generic” selected. Figure 16 illustrates.

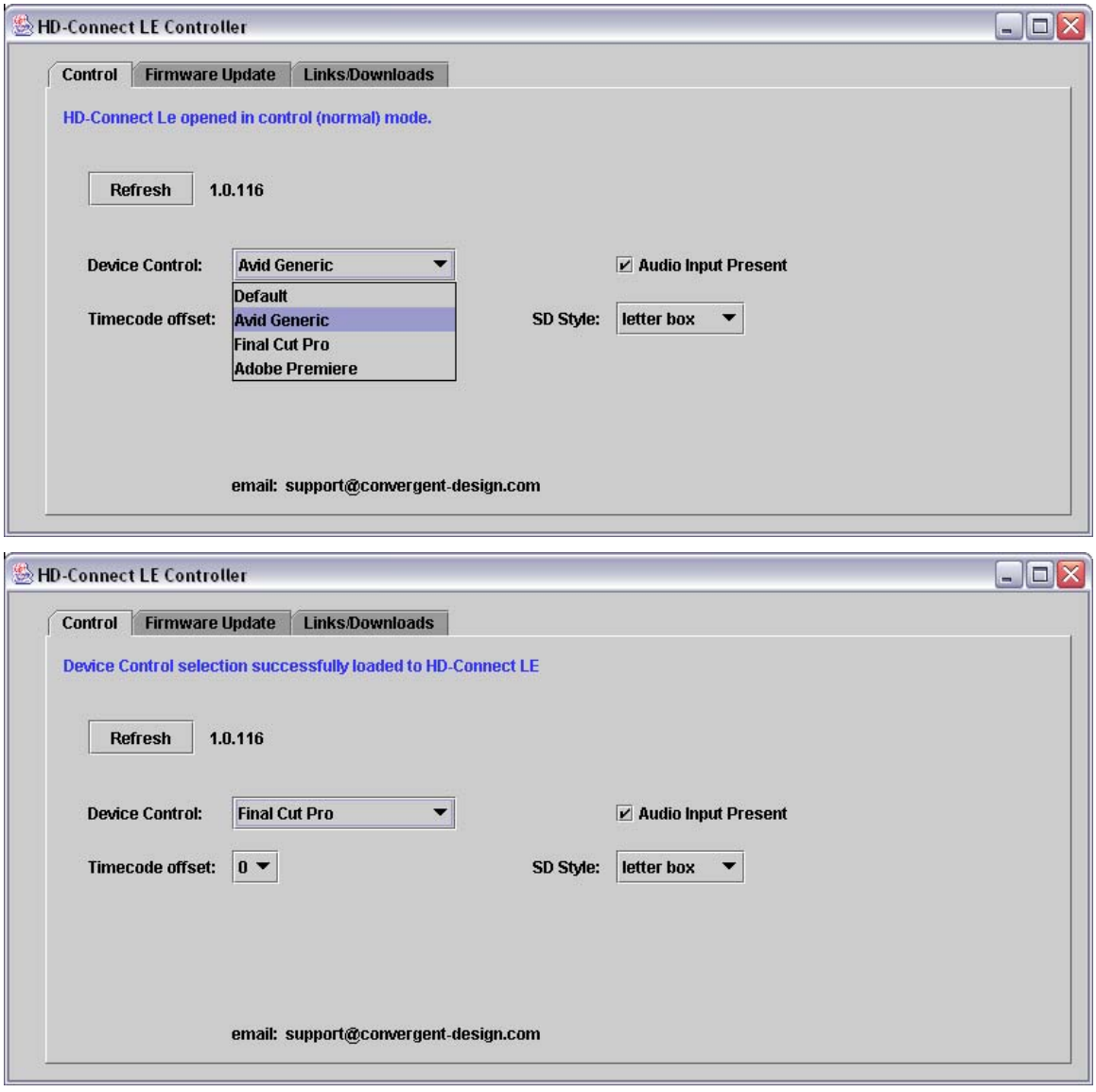


Figure 16 Device Control selection confirmation.

2) *Timecode Offest.* This setting allows you to add an offset to the timecode that will be reported to an RS-422 controller. HD-Connect LE™ already imposes its own offset to account for frame latency through the box.

Should you have other pieces of equipment downstream from HD-Connect LE™ that add further frame delays through your setup, you may wish to set an additional offset here.

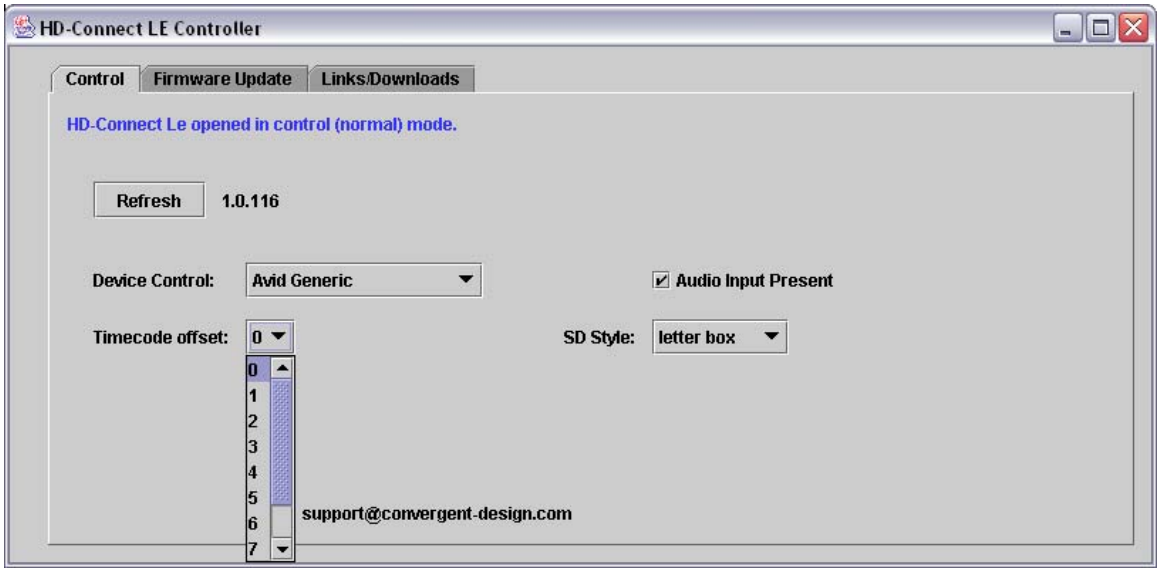


Figure 17 Timecode Offset Selection.

3) *Audio Present.* This checkbox indicates whether audio should always be present in the HDV data that streams to HD-Connect LE™ over the 1394 bus. For capture of source material from an HDV device, this checkbox should normally be checked, since the device should always record audio as it records the source material in the field. When HD-Connect LE™ knows that audio is expected in the HDV stream, it can correct for problems that arise at scene transitions in the playback from certain HDV sources and ensure that audio start up faithfully each time a controller asks the device to play forward at normal speed. On the other hand, for decoding HDV material that has been processed by an editing application and recording it to tape, or for playing back material so recorded, this checkbox should be unchecked. If it is left checked, HD-Connect LE™ will expect audio and will repeatedly reset its decoding logic when it fails to find audio data, causing the video to flash off and on.

4) *SD Style*. This drop down menu lets you select with what style the video should be scaled in Standard Definition mode. This feature can either be selected using the Control App (with DIP switches 6 and 7 both off), or can be manually selected using the right combination of switches 6 and 7. The

choices are Letterbox, Edge Crop, or Anamorphic. Figure 18 illustrates.

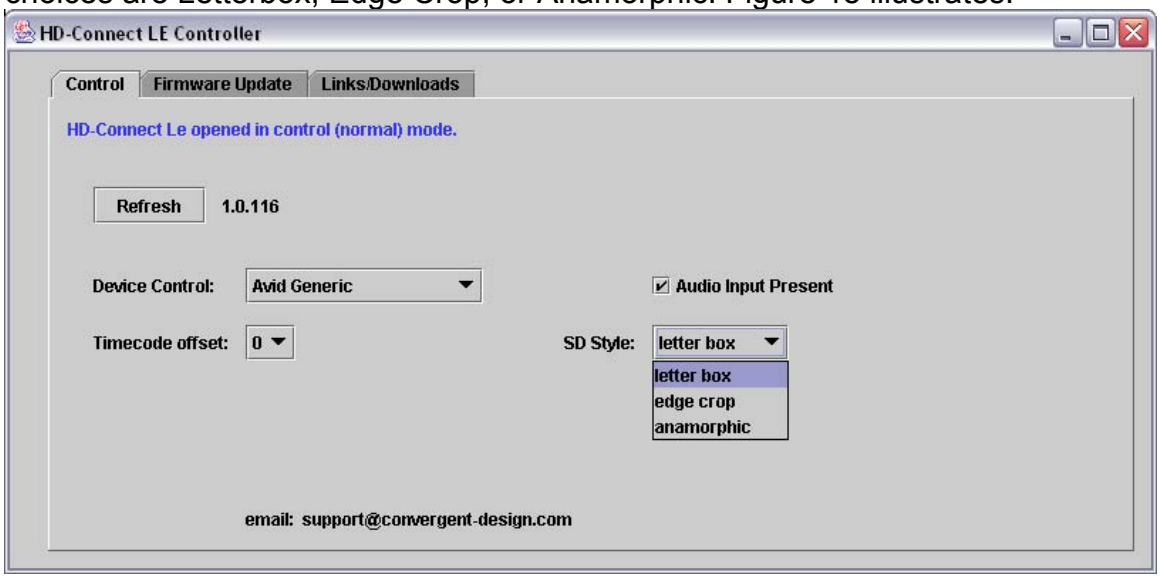


Figure 18 SD Scaling Features

6 Tips, FAQs, and Troubleshooting

6.1 Operating Tips

The follow are recommendations for video-editing workflow and operation of HD-Connect LE™ with other products that may appear in your configuration.

1) Offline/Online Workflow. While HD-Connect LE™ will allow you to use your RS-422 controller to navigate through a tape in an HDV device, it is best to reserve this capability for a rough look at source material rather than for logging in and out points for later batch capture. Due to the GOP (Group Of Pictures) structure of MPEG video and the transport limitations of HDV devices, navigation can be quite choppy compared to navigation through a tape on an RS-422-controlled deck. Timecode reporting issues (see *Using the Control Application/Control Operations*) make the logging of inpoints and outpoints problematic. For both ease of clip logging and frame-accuracy in the final captured clips, it may be better to capture an entire tape at a low resolution, decompose the captured material through an editing application into clips that will be a part of the final project, and then capture just those clips again at the desired final resolution

   Two scenarios illustrate this approach. In the first, the DV scenario, material from source tapes is captured directly using a DV editing application and the DV output from an HDV device. In the second, the SDI scenario, source material is captured instead from one of the SDI

outputs on HD-Connect LE™ connected to an SDI card installed in the editing computer. The discussion below focuses on the advantages and disadvantages of these two scenarios.

The DV scenario supports a simple offline capture and edit process that can be accomplished on a laptop. Since the material is captured in a format (DV) available as a direct output of the camera, the offline stage of the process does not require any equipment beyond the camera and the editing computer. Given minimal equipment and the relatively low DV data rate, material could easily be captured and edited in the field. For Avid users, DV also opens up the possibility of capture and edit on low-cost Xpress Pro systems followed by full-resolution capture and finishing on high-end Avid products. Of course, capturing and editing in DV will mean that editors have no choice but to work with lower-quality standard-definition video. Another problem in the DV scenario is that timecode for the offline capture will be from one device in one mode (the camera in DV mode), while the final online capture will be from a different device in a different mode (HD-Connect LE™ in HD mode). It may be necessary to set a timecode offset in the capture application to ensure that the logged DV inpoints and outpoints correspond to the correct frames during final online capture through HD-Connect LE™. In addition, some HDV devices will not down-convert to SD and provide a DV output, so this scenario would not be possible with all HDV devices.

While the need for an SDI capture card (HD or SD) in the SDI scenario eliminates the possibility of capturing and editing on a laptop or with Avid Xpress Pro, the SDI offline/online scenario eliminates the difference in timecode source, since clips are captured through HD-Connect LE™ at both offline and online stages. Also, the SDI scenario allows the selection of a number of different codecs for video compression during the offline tape capture. With SD-SDI output from HD-Connect LE™ set in SD mode, a software DV codec could achieve the same savings in disk space as in the DV scenario. For higher-quality material during offline capture and edit, HD-Connect LE™ could be set in HD mode and a DVC Pro HD codec used to compress captured video. Recapture of just the final project clips could then be done at the full HD data rate. The SDI scenario is also more universal than the DV scenario, since it covers an HDV source such as the JVC BR-HD50 deck that do not down-convert to DV.

The table below summarizes the advantages and disadvantages of the DV and SDI scenarios.

	DV Offline Capture	SDI Offline Capture
Advantages	• Laptop ok • Avid Xpress Pro ok • Minimal equipment • Low data rate	• SD or HD • Choice of SD or HD codecs (DV, DVC Pro HD, etc.) • Ok for HDV device without down-conversion
Disadvantages	• Lower offline quality • SD only • DV compression only • May need timecode offset in edit app • Requires HDV device that down-converts	• No laptop • No Xpress Pro

2) Continuous Timecode and Leaders in Video Capture. For purposes of searching in the course of a batch capture, it is best to have a tape without timecode breaks. A camera in free-run timecode mode will continue to advance its internal timecode while the camera is not recording. This can create significant gaps in timecode from one clip recording to the next and may cause search problems in later searches. Even greater problems arise when there are multiple instances of the same timecode on a single tape. For best results, the camera should be set in record-run mode with a desired starting timecode and the timecode not reset until the full tape has been recorded. This should cause the camera to begin advancing its internal timecode only each time the record button is pushed. It is also recommended that the first scene recorded on a tape have a leader of 30 seconds or more of sacrificial material in order to prevent a reverse search from overrunning the timecodes on the tape. There should also be a leader before each subsequent scene at least as long as the preroll during batch capture. The recommended preroll time for a batch capture is 6 seconds

3) Avoiding Multiple IEEE-1394 Devices. On any reset of the 1394 bus (e.g., on power-up or plugging or unplugging a 1394 device), HD-Connect LE™ searches the bus for the first HDV device it can find. Where there is more than one, any beyond the first are ignored. The order in which devices are queried may change from one reset to the next, so it is best never to have more than a single HDV device plugged in at the same time. With more than one device on the bus sending out

queries in the wake of a bus reset (e.g., HD-Connect LE™ and a PC or Mac), communications between HD-Connect LE™ and an HDV device may fail. This is known to happen with the Canon XLH1 camera. This seems to result from queries from HD-Connect LE™ and the computer arriving at the HDV device too close to one another. It is best, especially with the Canon camera, to include only HD-Connect LE™ and a single HDV device on the 1394 bus and plug a computer in only to run the update or controller application for HD-Connect LE™.

4) Avoiding Avid Auto-Configure. Rather than use Avid's automatic deck configuration, select Generic Play Deck as a specific device-control template.

5) Avid Check Decks Retries. If a Check Decks operation from Avid fails, just do the check again. Testing has shown that the Check Decks operation sometimes sends a couple of lead bytes that cannot be part of a legitimate RS-422 command.

6.2 Frequently Asked Questions

1) What are the capabilities of HD-Connect LE™? The HD-Connect LE™ is a compact HDV → HD/SD-SDI converter box with component (HD/SD) and composite (SD only) as well as LTC and AES audio outputs. Deck control is supported via RS-422 → 1394 (available now) or 1394 → RS-422 (upcoming feature).

2) Can you perform HD-SDI → HDV conversions? No, the box only decodes (HDV→ HD/SD-SDI); it does not encode (HD-SDI→ HDV) video/audio. An economical HDV encoder is about 12-18 months away.

3) Can I copy an HDV tape to HD-CAM deck? Yes, simply connect the HD-SDI output from the HD-Connect LE™ to your HD-CAM deck. The video, audio, and time code are all carried through this single connection.

4) Can I edit in HDV and then output to HD or SD decks? Yes, one of the advantages of using "native HDV" editing with the HD-Connect LE™ is the ability to output your finished project in either HD or SD formats (though not both simultaneously). Supported decks include HD-CAM, DigiBeta, DVC-Pro HD, and BetaCam SP.

5) What is the frame latency through the box? There is a latency of one to three frames through the HD-Connect LE™. The overall latency from a live camcorder shoot is about eight to ten frames, due to the frame delay in the camcorder.

6) What does the HD-Connect LE™ offer over similar HDV products?

- The ability to downscale to standard definition video as well as cross conversion (720p ↔ 1080i).
- Smaller size, lower cost, less power.
- 24 fps support.
- 1394 → RS-422 control (upcoming feature).

7) What are the various input formats supported?

The MPEG2 (HDV) formats include:
- 1440x1080i, 29.97 Hz
- 1440x1080i, 25 Hz
- 1440x1080i, 23.98 Hz
- 1280x720p, 59.94 Hz
- 1280x720p, 50 Hz
- 1280x720p, 29.97 Hz
- 1280x720p, 25 Hz
- 1280x720p, 23.98 Hz

8) What is the maximum MPEG2 data-rate? Up to 40Mbps.

9) Can HD-Connect LE™ decode other MPEG streams, besides HDV? Yes, the board supports most of the ATSC (ISO/IEC 13818-2) streams, but is limited to bit rates below 40Mbps.

10) Does the HD-Connect LE™ support DV? No, this is a likely feature for a future box in the HD-Connect family.

11) What is the data rate of HDV? 720p HDV is approximately 19Mbps, 1080i is 25Mbps.

12) What is the recommended workflow using HD-Connect LE™? Use HD-Connect LE™ to convert from HDV to HD/SD-SDI via firewire. Connect the HD-SDI output to an HD/SD-SDI capture card. Capture the video and audio either uncompressed or using the I-Frame CODEC such as DVCProHD or DNxHD. You can control the HDV deck by connecting the RS-422 from your capture card to the LE box.

13) I edit native HDV on my laptop, how do I monitor HDV and master to tape? Connect your HD-Connect LE™ to your firewire port and do a "Print to Tape". You can monitor the video via the composite output (when scaled down to SD) or an analog component or SDI monitor. Using the upcoming HD-Connect LE™ 1394→RS-422 control, you can use this same setup to output to a BetaCam, DigiBeta, or HD-CAM deck.

14) Can I output to a DigiBeta deck? Yes, the SD-SDI includes audio and will include time code in an upcoming release. Connect the SDI output directly to the DigiBeta deck and set the box up in SD mode. Connect the LTC out of the HD-Connect LE™ to the in of the DigiBeta deck. The DigiBeta deck will lock to the HD-Connect LE™ SDI connection, so no reference is required.

15) Can I down-convert my HDV project and output to a BetaCam deck? Yes, just connect the component outputs to your BeatCam deck and the composite out to the reference input of the deck. The Beta deck will flash "Invalid Ref", but the video will be recorded correctly. Connect the AES out of the box to an audio A/D converter with balanced outputs. Then connect the balanced outputs to your BetaCam audio inputs.

16) I have a high-end Avid system, how can I import HDV? First, connect a 1394 cable between your HDV source and the HD-Connect LE™. Then connect the HD-SDI output from the box to your Avid system. Finally, connect an RS-422 from your Avid system to the HD-Connect LE™. Using the selector switches, set the video output to HD or SD and 1080i or 720p as appropriate. Set the deck control to RS-422. You can now drive the HDV deck/camcorder from your Avid NLE program.

17) Which NLE software programs work with HD-Connect LE™? For native HDV editing, we have tested the following: Sony Vegas and Final Cut Pro (need to test Avid, Premiere, and Liquid Edition). For HD/SD-SDI editing, we have tested the following: Avid, Final Cut Pro, Media 100, Leitch Velocity, etc.

18) I use Final Cut Pro and want to edit all the material using the DVCProHD codec, can the HD-Connect LE™ help with HDV material? Yes, use the HD-Connect LE™ to convert HDV→ HD-SDI and then capture into FCP via an HD-SDI card (AJA or Blackmagic, for example) using the DVCProHD codec.

19) Is HDV at 24fps (actually 23.98 fps) supported? Yes, in both 720p and 1080i formats.

20) What are the possible output formats? There are six output formats (SDI and Component):
- 1920x1080i, 29.97 Hz, 16:9, 4:2:2 color space
- 1920x1080i, 25 Hz, 16:9, 4:2:2 color space
- 1280x720p, 59.97 Hz, 16:9, 4:2:2 color space
- 1280x720p, 50 Hz, 16:9, 4:2:2 color space
- 720x480i, 29.97 Hz, 4:3, 4:2:2 color space
- 720x576i, 25 Hz, 4:3, 4:2:2 color space

21) What are the SD output formats? Anamorphic, edge crop, and letter box, selectable on the bottom of the HD-Connect LE™ or through the Control App.

22) Does the box upscale the 1080i HDV from 1440 to 1920? Yes, using a multi-tap filter for smoother scaling.

23) Is the video stream 8-bit or 10-bit resolution? All HDV video is 8-bit resolution. Video is extended to 10 bits before transmission over HD/SD-SDI.

24) Can the box perform frame rate conversions (50i→60i, for example)? Yes, but we do not recommend this feature.

25) How does the downscaled video (SD) compare to the DV out of the HDV camcorder? The downscaled video is definitely superior because it has only seen one compression (HDV). The DV video has seen an HDV compression followed by a DV compression after downscale.

26) Does HD-Connect LE™ work in true NTSC frame rates (29.97fps)? Yes.

27) Can I add color or gamma correction to the video? A firewire-based control application is planned for 2nd quarter 2006 release, which will include the capability to adjust colors, stretch the black levels, and program a specific gamma curve.

28) Does HD-Connect LE™ support true SD (BT-601) and HD (BT-709) color spaces? Yes, a color space conversion is automatically performed to convert between the SD and HD color spaces as necessary.

29) How can I edit HDV shot with the JVC HD100 (720p) and Sony Z1 (1080i) together? HD-Connect LE™ includes a cross converter (720p↔1080i), so you can convert video into either format.

30) Does the box work with HDV camcorders from Sony, Canon, and JVC? Yes, all three are supported.

31) How do I select the output format? Using the selector switches on the bottom of the box, you can select the desired video output format. The box automatically detects the format of the incoming HDV and scales the video, as necessary, for the desired output.

32) What is the data rate of the uncompressed HD and SD stream?

- 1080i HD= 125Mbytes/sec
- 720p HD= 110Mbytes/sec

- SD Video= 21Mbytes/sec (8-bit)

33) Are the analog component, SDI, AES, and LTC outputs all active (hot)? Yes, you can use all the outputs simultaneously, though the analog composite output is active in SD mode only.

34) Can I connect the outputs to an LCD or Plasma panel? Yes, via the component outputs. You can also view the video on a composite video monitor (SD mode only). Additionally, one of the HD-SDI outputs could be connected to a low-cost HD-SDI→ DVI/HDMI converter box for pure digital connection.

35) Can I get HD and SD out simultaneously? No, if you select HD, then the component and SDI outputs are all operating in HD resolution (720p or 1080i as selected by the switches). If you select SD, then the analog and SDI outputs all output in standard definition mode. (The Composite out only works in SD mode).

36) Can I control an HDV Camcorder from an RS-422 cable? Yes, the HD-Connect LE™ converts the RS-422 deck commands and time code queries to 1394 AV/C commands.

37) How does the HD-Connect LE™ handle time code? The time code is read from the HDV source (over firewire), and then transferred to SDI, LTC, and RS-422 simultaneously. From the control application you may select from embedded or queried time-code. Embedded time code is extracted from the HDV stream, while queried time code derives from device responses to AV/C time-code queries sent out over the 1394 bus. Use of embedded time codes will generally lead to somewhat more frame-accurate batch captures. When the HDV device is not playing, HD-Connect LE™ will always report queried time codes.

38) Will the box convert 1394 deck control commands to RS-422? Yes, just set the selector switches accordingly. (Coming soon)

39) Has the audio/video synchronization been verified? Yes, A/V (lip sync) has been tested and found to be in sync.

40) Can I monitor the audio out? Yes, there is a 3.5mm stereo audio (unbalanced) output for monitoring.

41) Is the audio compressed? The HDV audio is compressed using MPEG-1 Layer 2 standard. The output of the HD-Connect LE™ box is decompressed to 16-bit 48Khz audio (for AES, SDI-embedded, and unbalanced analog output).

42) How many channels of audio are in the HD or SD-SDI stream? Four channels are transmitted, but only audio channels 1-2 have data. Audio channels 3-4 are muted because HDV only has two channels of audio.

43) Can the firmware be updated in the field? Yes, a 1394 update utility is available. The update utility and new firmware can be downloaded from the Convergent Design website (http://www.convergent-design.com).

44) What is the physical size of the box and it's power requirements? The overall size (including connectors) is: 6" x 4" x 1.75" (152 x 101 x 44 mm). At less than 1 lb (0.5kg) the box is very lightweight. The box consumes about 5 Watts of power; an external 5V power supply (with universal AC 100-240V) is included with each HD-Connect LE™ box.

45) I understand that the JVC camcorder has two additional channels of uncompressed PCM audio. Does the HD-Connect LE™ support this function? No, we are still investigating if this is possible.

46) Can I capture in true 24p mode? The current code version embeds the Varicam flags in the HD-SDI stream for 720p 59.9 output, allowing the NLE capture software to capture only the original 24 frames of data, dropping the repeated frames.

47) Where can I find additional information?

- http://www.convergent-design.com
- Your local Convergent Design dealer (see website)
- sales@convergent-design.com
- ++(720) 221-3861

6.3 Troubleshooting Guide

1) No output from the box.

   - Try selecting color bars. (Unplug all 1394 devices to turn color bars on. Color bars only output on the HD/SD-SDI connections, not analog)
   - Check that the HDV source is set to HDV output AND has an HDV (not DV) tape.
   - Check output from HDV source (deck or camcorder)
   - Check that DIP switch 8 is “Off”.

2) Video is jumpy

   - Check to see if the box is in NTSC or PAL and matches the standard of the video you are working with.

3) Box failed to update

   - Check to see that DIP switch 8 is “On”.
   - Make sure the computer recognizes the box before updating.
   - Repeat update with the “Update Minimum only” box unchecked.
   - Roll back to a previous working version.

4) RS-422 Deck control does not work.

   - Be sure the direction of control is set correctly. Refer to the directions on the DIP switch 4 settings to choose the correct direction.
   - Select a generic play deck as the deck template in the NLE software.

5) I only see color bars when I turn on the box.

   - When there is no HDV device attached via 1394, the HD-Connect LE displays color bars in the selected output mode.

6) I can’t stream any video when I plug my HD-Connect LE™ into my computer.

   - Be sure that the box is not in update mode.
   - Make sure that the box is in 1394 mode (switch 4 on the bottom).

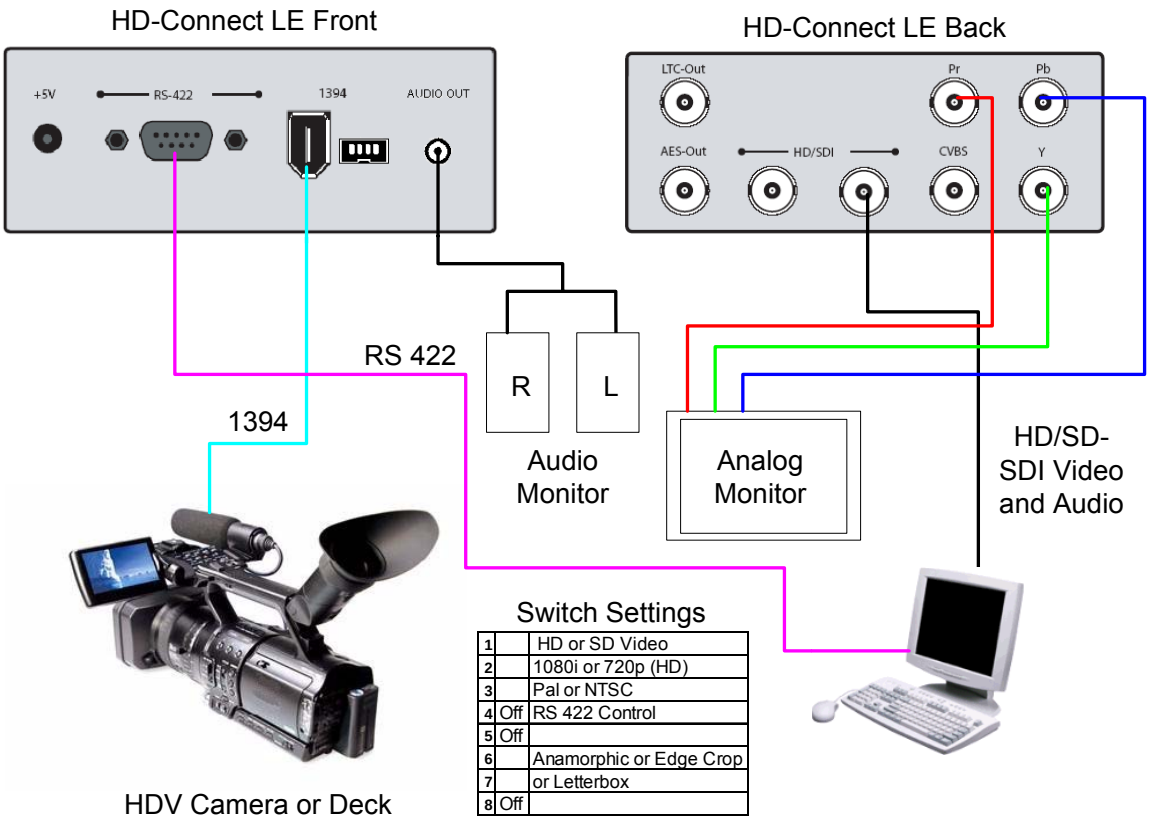
7) My computer won’t recognize the HD-Connect LE™.
   - Again, be sure that DIP switch 4 is set for 1394 mode.

7 Safety and ESD Precautions

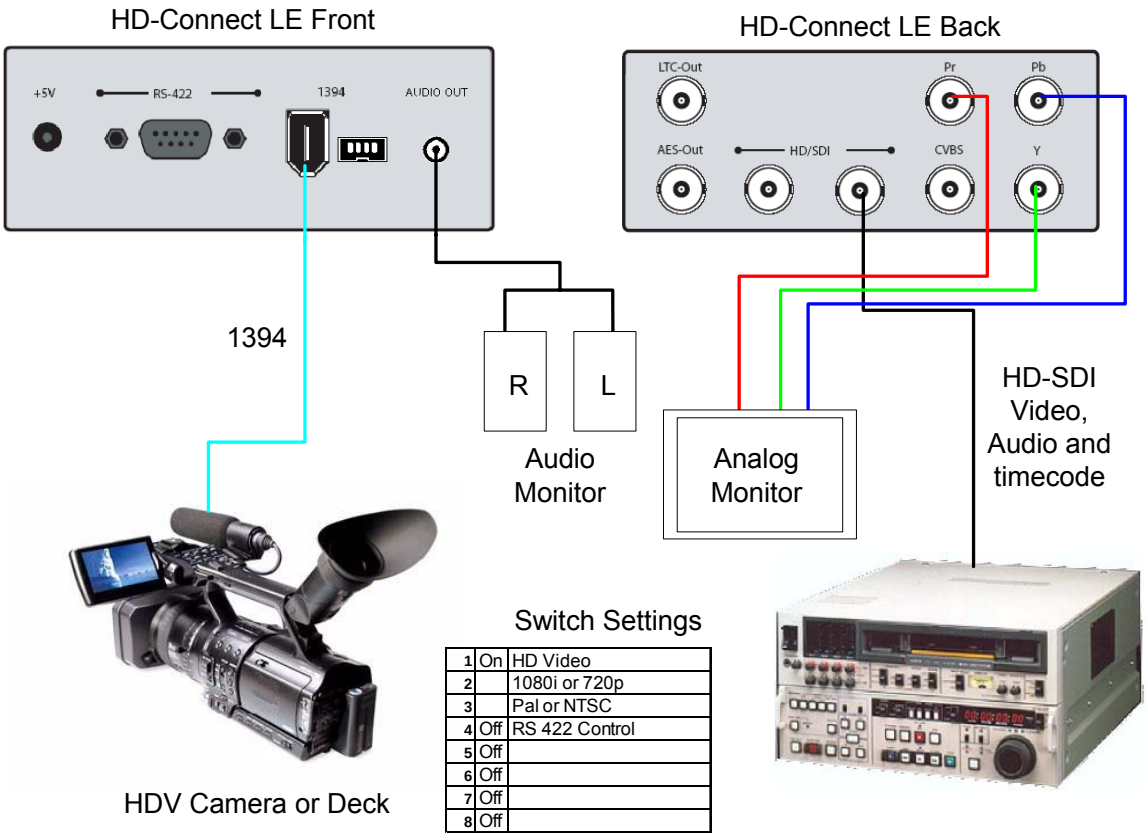
1) Always connect the box to specified power source: 100 to 240 V AC, 50/60 Hz. DO NOT use any power supply other than the one supplied with the HD-Connect LE™, as this voids the warranty.
2) Do not operate the unit in an unprotected outdoor installation or in wet areas. Do not expose this product to rain or snow.
3) Keep the operating temperature between 5º C and 40º C (40º F and 104º F). Avoid conditions which would cause moisture condensation on the outside cover.
4) There are no user serviceable components inside the box. Only a qualified technician should perform servicing of the unit. Opening the box may void the warranty.
5) Do not pour water or any other fluid over the box. Avoid the use of sharp objects near the box as they may scratch the anodized aluminum case or damage the DIP switch and board.
6) Clean only with water with a damp cloth.
7) CAUTION: Electrostatic Discharge (ESD) can damage components in this product. Although HD-Connect LE™ has countermeasures to this hazard installed inside, it is always best to avoid damage by using extra caution when adjusting the DIP switch settings.
8) Do not touch exposed connector pins and do not insert any metal objects in the connectors.
9) Because it is powered, take extra caution when plugging in the 1394 port 6-pin connector. DO NOT cock the connection or you risk destroying the port. Blown firewire ports are not covered under the warranty.
10) Ensure that all connections made to the box (including at the “other end of the cable”) are made in ESD safe environments.
11) Always transport and store the box in the static protected bag included with the HD-Connect LE™
12) Do not use mechanical pencils to adjust the DIP switches, as this deposits lead stains on the switch that are impossible to remove.

8 Connection Diagrams and Applications

8.1 HDV Capture with HD/SD-SDI based editing system



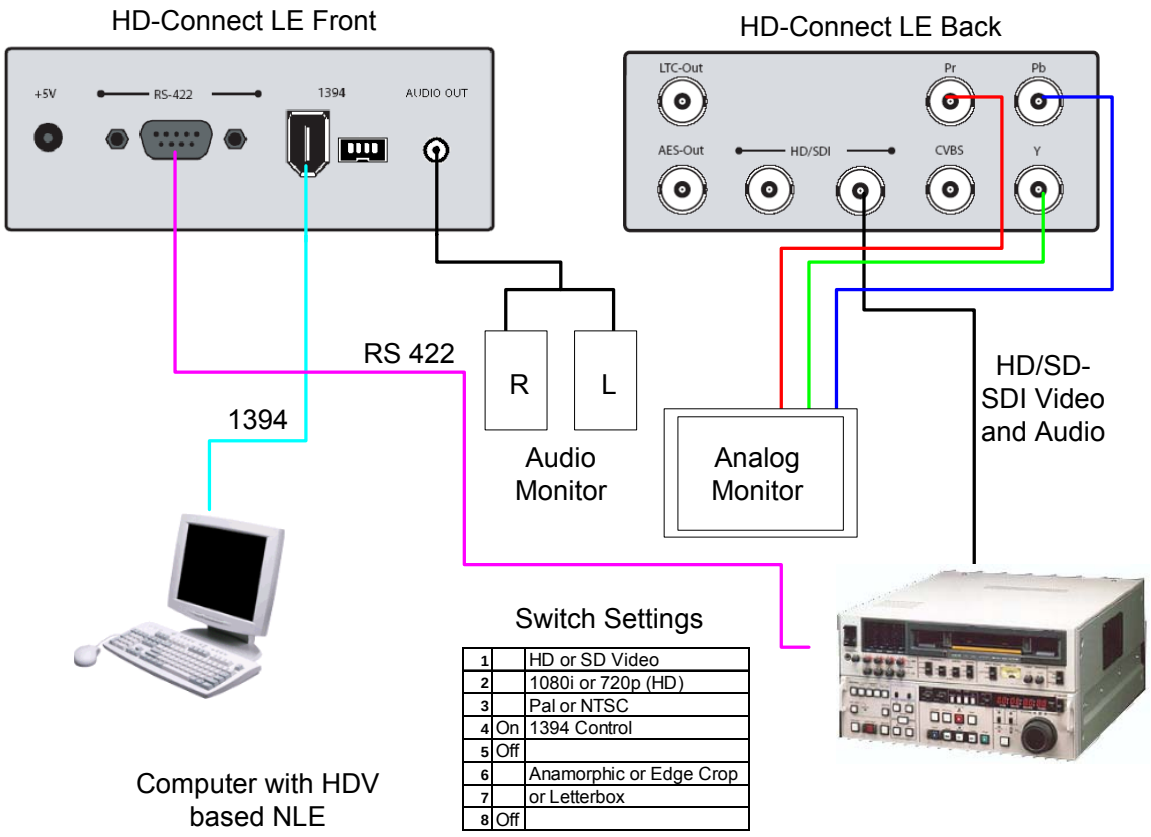
8.2 HDV Dub to High Definition Deck



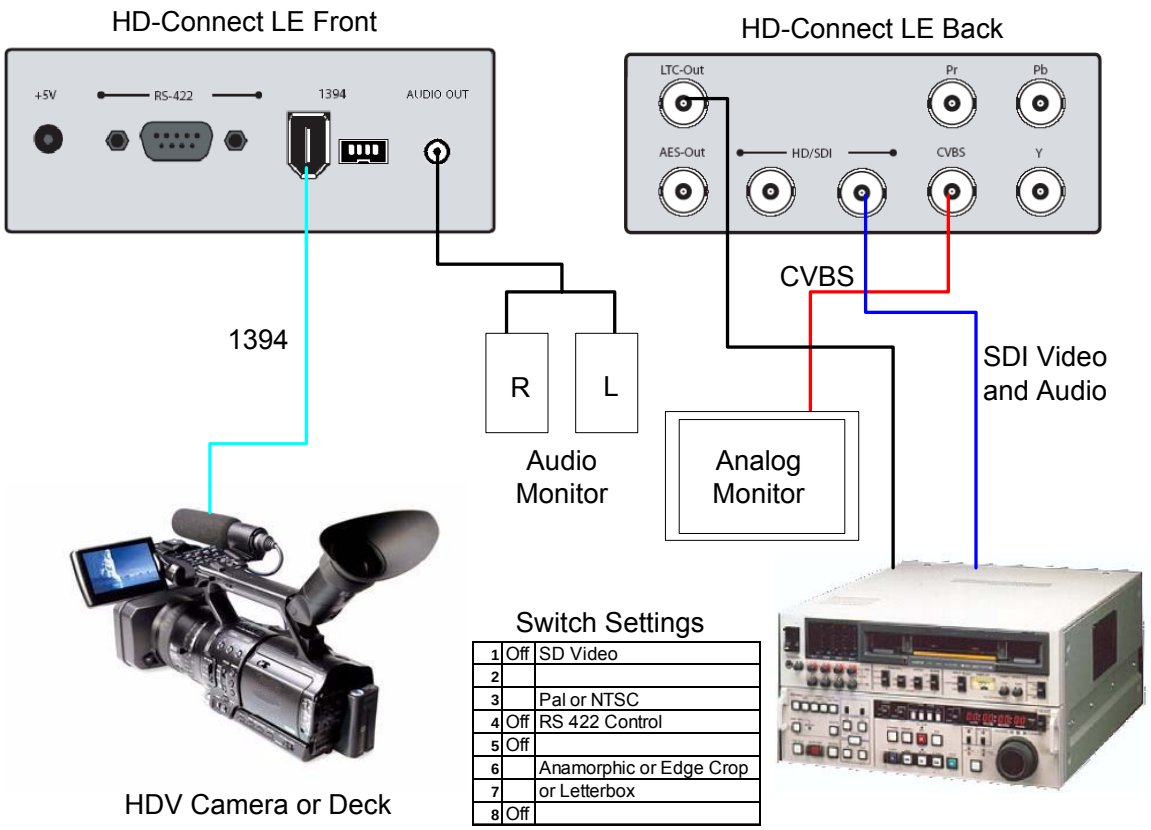
Switch Settings

1	On	HD Video
2		1080i or 720p
3		Pal or NTSC
4	Off	RS 422 Control
5	Off	
6	Off	
7	Off	
8	Off	

8.3 HDV Playback from Computer



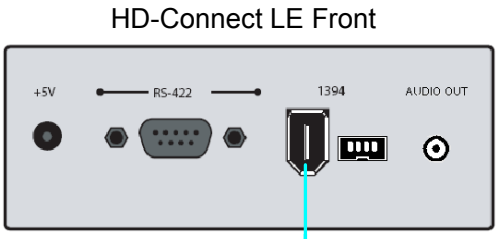
8.4 HDV Downscaled to Standard Definition

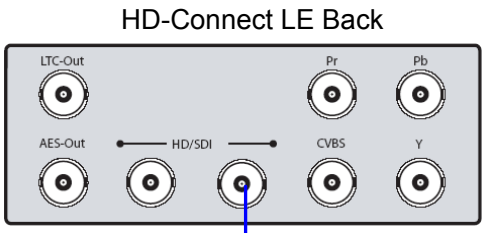


Switch Settings

1	Off	SD Video
2		
3		Pal or NTSC
4	Off	RS 422 Control
5	Off	
6		Anamorphic or Edge Crop
7		or Letterbox
8	Off	

8.5 HDV to HD-CAM Tape Transfer w/ Time Code





1394

HD-SDI Video, Audio & Time Code

HDV Camera or Deck

Switch Settings

1	On	HD Video
2		1080i or 720p
3		Pal or NTSC
4	Off	RS 422 Control
5	Off	
6	Off	
7	Off	
8	Off	

9 Specifications

9.1 Inputs

HDV (MPEG2)
Formats:

- 1440x1080i, 29.97Hz
- 1440x1080i, 25Hz
- 1440x1080i, 23.98Hz
- 1280x720p, 59.94Hz

- 1280x720p, 50Hz
- 1280x720p, 29.97Hz
- 1280x720p, 25Hz
- 1280x720p, 23.98Hz

Connector: IEEE-1394a 6-pin and 4-pin

9.2 Outputs

HD-SDI

Standards:

- SMPTE High Def Color Bars RP-219
- 4:2:2 SMPTE 292M
- 4 Channel Embedded Audio
- 24-bit, 48Khz, SMPTE 299M

Formats:

- 1920x1080i, 29.97Hz, 16:9
- 1920x1080i, 25Hz, 16:9
- 1280x720p, 59.97 Hz, 16:9
- 1280x720p, 50Hz, 16:9

Connectors: 75 Ω BNC

SD-SDI

Standards:

- SMPTE Standard Def Color Bars RP-178
- 4:2:2 SMPTE 259M-C
- 4 Channel Embedded Audio
- 20-bit, 48Khz, SMPTE 272M-A

Formats:

- 720x480i, 29.97Hz, 4:3
- 720x576i, 25Hz, 4:3

Connectors: 75 Ω BNC

Analog Video

Standards:

- Component (G/Y, B/B-Y, R/R-Y)
- Composite (CVBS)

Connectors: 75 Ω BNC

LTC

Standards:

- SMPTE 12M
- Level: 1 Vp-p

Connector: 75 Ω BNC

Embedded Time Code

Standards:

- SMPTE RP-188

AES Audio

Standards:

- AES-3/EBU
- Level: 1 Vp-p
- Impedance 75 Ω

Connector: 75 Ω BNC

Analog Unbalanced Audio

Standards:

- Level: 1 Vp-p

Connector: 3.5 mm Stereo Plug

9.3 Physical

Dimensions

- 4” (101 mm) deep X 1.75” (44 mm) high X 6” (152 mm) wide

Weight

- 1 lb. (0.5 kg)

9.4 Power

Range

- 100 to 240 V AC (50/60 Hz)

Maximum Operating

- 6W

9.5 Temperature Ranges

Operating

- 40º F to 104º F (5º C to 40º C)

Storage

- -5ºF to 140ºF (-20º C to 60º C)

9.6 Humidity

Operating

- Less than 80% (non-condensing

Storage

- Less than 90% (non-condensing)

10 RMA and Warranty

10.1 Conditions of the Warranty

Convergent Design reserves the right to determine if a repair is subject to the warranty agreement. Damages caused by products being dropped or mishandled is not covered by this warranty. Also damage caused by over-voltage conditions on any of the I/O connectors is not covered by this warranty. Use of any power supply other than the one provided automatically voids the warranty.

Care must be taken when plugging in the 1394 connector. The 6 pin connector has power connections, as well as the transmit and receive signals. If the 1394 connector is attached at a cocked angle or upside down, you risk touching the power connection to the data lines, which almost always results in destroyed 1394 hardware in the circuitry. This action is not covered under this warranty.

There are no user-serviceable parts inside the cabinet. Opening the cabinet voids the warranty. Transit damage caused by inadequate packaging also invalidates the warranty agreement. Please ship the unit in its original packaging, if possible.

All products are shipped prepaid to Convergent Design. For insurance reasons, Convergent Design cannot accept any product that is returned via U.S. Postal Service. Returns will be accepted from Federal Express, UPS, DHL, or other comparable freight carrier. Convergent Design returns the product via a prepaid two-day delivery service within the continental United States, only if the product is under warranty and subsequently found to be faulty. Out-of-warranty repaired products are shipped at customer's expense. Turnaround time for warranty repairs normally will not exceed 48 hours (excluding shipping time), unless extraordinary fault conditions exist. A failure analysis report is returned with each product.

Labor and defects are covered for the warranty period stated on your original invoice from the original date of purchase. Only the original purchaser of the products is covered under this warranty. The warranty is non-transferable. If you discover a defect, please refer to our Return Merchandise Policy below. The warranty covers all Convergent Design hardware defective in material or workmanship. Software is warranted in a separate written statement accompanying the software. During the warranty period, Convergent Design, at its option, will repair or replace product or product components, which in its opinion prove defective. Parts and components used in the repair process may be recycled or repaired, at Convergent Design's discretion. This warranty service

will be performed at no charge to the registered owner, provided the product is shipped prepaid to Convergent Design. Convergent Design will return the repaired product via a like carrier, in the continental United States within 48 hours, shipping time excluded. Convergent Design reserves the right to determine whether a needed repair is subject to the warranty as per its provisions sated herein. Transit damage caused by inadequate packing violates the warranty. The warranty will be void if, in the opinion of Convergent Design, the product has been damages through accident, misuse, misapplication, or as a result of service or modification performed not authorized in writing by Convergent Design.

10.2 Obtaining an RMA

It is our policy that all material and repair returns, whether in warranty or not, are only accepted if an RMA (Return Merchandise Authorization) number has been issued for the products being returned. Any unauthorized shipments will be returned, un-repaired at the customer's expense.

Damaged or defective Convergent Design products that are purchased from Convergent Design may be returned for replacement only. Convergent Design will not accept returns for any other reason. All eligible returns require a Return Merchandise Authorization (RMA) number. E-mail Convergent Design, Inc. at support@convergent-design.com to obtain an RMA number. Items must be returned within 10 days of receiving your RMA number. Returned product must be in its original packaging with all contents included and must have the RMA number clearly marked on the outside of the package.

RMA numbers and return address may be obtained from Technical Support.

Convergent Design, Inc.

4465 Northpark Drive

Suite 201

Colorado Springs, CO 80907

EMAIL: support@convergent-design.com

WEBSITE: http://www.convergent-design.com

VOICE: (720) 221-3861 or (866) 654-0080